



1. INTRODUCTION

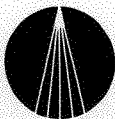
This Post-Demolition Risk Assessment was developed to evaluate the health protectiveness of post-demolition site conditions at Parcel A of the Boeing C-6 facility in Los Angeles, California. Specifically, does Parcel A adequately protect the health of future users? Also, what are the health impacts, if any, associated with redevelopment of the parcel as a commercial/industrial facility?

The 170-acre C-6 facility (Figure 1-1) has been used since the 1940s for industrial purposes but is currently undergoing a phased demolition and redevelopment. During each phase of the project, a post-demolition risk assessment will be conducted for the parcel undergoing redevelopment.

This risk assessment was prepared following the procedures and methodologies described in relevant guidance documents from the California Environmental Protection Agency (Cal/EPA) and U.S. Environmental Protection Agency (EPA). The objective, scope, and key assumptions presented have been discussed with and agreed to by the lead regulatory agency for the C-6 site, the California Regional Water Quality Control Board - Los Angeles Region (RWQCB-LA), and the lead agency for health risk, the Cal/EPA Department of Toxic Substances Control (DTSC).

1.1 OBJECTIVE AND SCOPE

The primary objective of this risk assessment is to evaluate the potential health risks to future users of the redeveloped parcel and to identify any localized "hot spots" requiring remediation (Cal/EPA 1997). As mentioned, exposures and associated risks are estimated assuming the construction and daily use of the parcel as a light commercial/industrial facility. This scenario and associated site conditions were developed in accordance with Boeing's proposed deed restrictions for Parcel A.



**FIGURE 1-1
BOEING C-6 SITE, LOS ANGELES, CA**

By agreement with RWQCB and DTSC, this risk assessment focuses on the potential health impacts posed by Parcel A soils. Based on the extensive amount of site data collected in the past 10 years, and the proposed deed restrictions, groundwater is unlikely to present significant exposures to current or future users and is not considered a health issue. Groundwater will be addressed separately, under RWQCB guidance.

As health-protective, upper-bound estimates of risk, the findings of this risk assessment will enable the site owner and regulatory agencies to assess the magnitude of potential risks



associated with Parcel A and to formulate a health-protective and cost-efficient exit strategy. As such, the findings are a vital risk-management tool for the agencies and current and future stakeholders.

1.2 SITE DESCRIPTION AND OPERATIONAL HISTORY

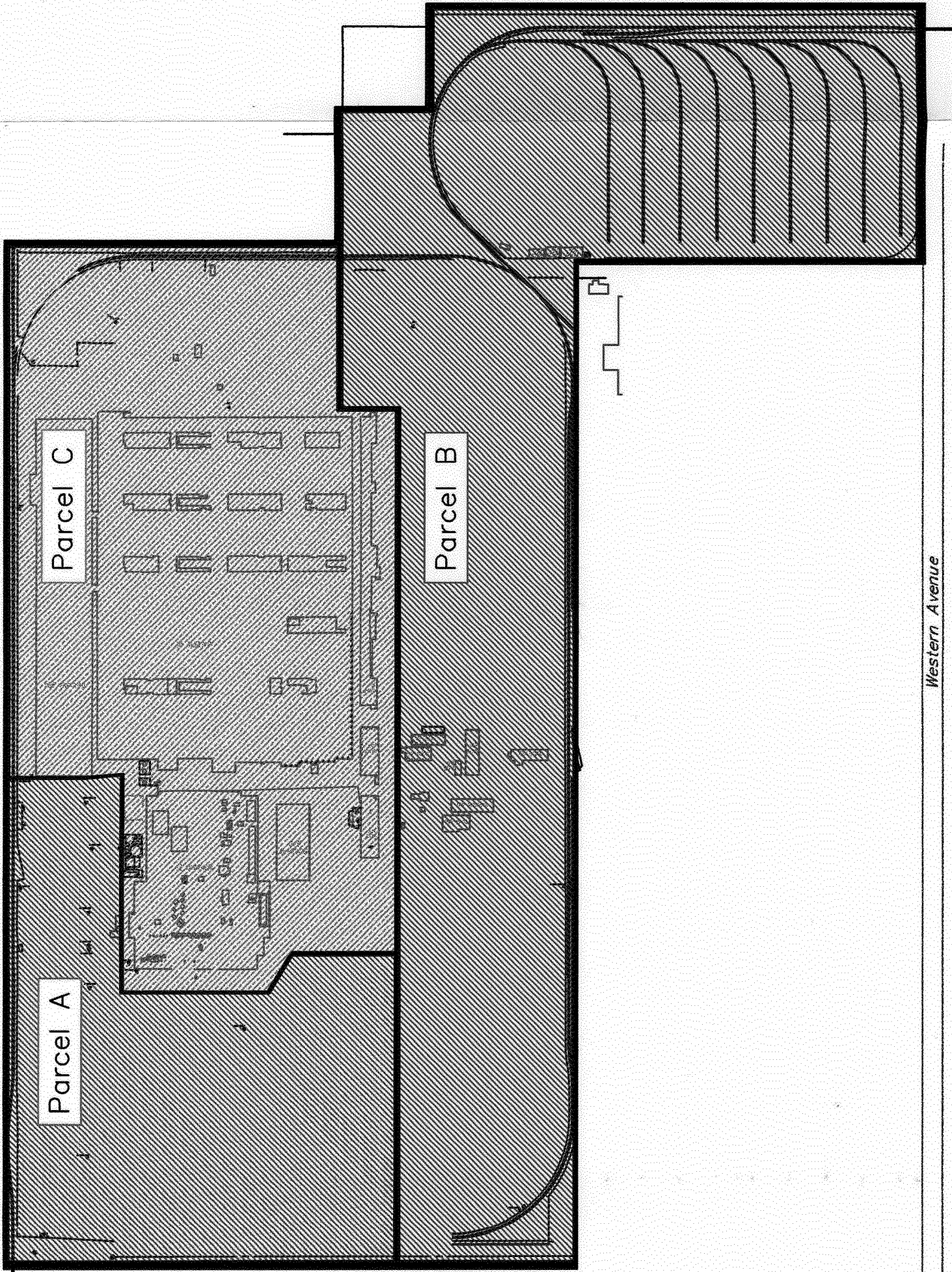
The C-6 facility (Figure 1-1) is located at 19503 South Normandie Avenue in Los Angeles, California, and is bordered by 190th Street to the north, Normandie Avenue to the east, 203rd Street to the south, and Western Avenue to the west. As shown in Figure 1-2, Parcel A fronts both 190th Street and Normandie Avenue.

Aerial photographs indicate that the area was farmland prior to the 1940s. Industrial use of the property began in 1941 when the Defense Plant Corporation (PLANCOR) developed the site as part of an aluminum reduction plant. The Aluminum Company of America (ALCOA) operated the plant for the government to produce aluminum during World War II. Five "pot lines" were originally constructed at the plant, but only three were placed in operation. ALCOA operated the plant until it was closed in September 1944 (CDM 1991).

The War Assets Administration then used the site for temporary storage during the following two years. In 1948, Columbia Steel Company purchased the property. No significant changes were made to the plant under Columbia Steel Company ownership (CDM 1991).

In March 1952, the US Navy purchased the property and established the Douglas Aircraft Company (DAC) as the contractor and operator of the facility for the manufacture of aircraft parts. DAC purchased the property from the Navy in 1970 and used the facility to manufacture components for various commercial and military aircraft until approximately 1992. Since cessation of manufacturing activities, DAC has used the C-6 facility to store and distribute aircraft parts (K/J 1996a, 1996b, 1996c).

Normandie Avenue



0 187.5 375
FEET

190th Street

Western Avenue

TITLE:

Boeing C-6 Facility
Parcels A, B, and C



INTEGRATED
Environmental Services, Inc.
5390 Redwood Place, Suite 210
Hayward, CA 94545 (415) 882-4000

DES:

JL

DWN:

JL

APPR:

MY

PROJECT NO.:

Boeing C-6
Parcel A

REV:

1

DATE:

3-6-98

FIGURE NO.:

1-2



Boeing Realty Corporation became the site operator responsible for cleanup in August 1997, when its corporate parent, the Boeing Company, acquired McDonnell Douglas. Boeing is working with multiple agencies on C-6 closure and redevelopment. In addition to RWQCB-LA and DTSC, the South Coast Air Quality Management District (SCAQMD) and the City of Los Angeles are involved.

Table 1-1 summarizes the land-use history of the C-6 property.

TABLE 1-1
LAND-USE HISTORY

Period	Land Use	Operator/Owner
Before 1941	Farmland	
1941-44	Aluminum reduction complex	ALCOA for Defense Plant Corp.
1944-48	Warehousing	War Assets Administration
1948-52	Warehousing	Columbia Steel Company
1952-70	Manufacture of aircraft parts	Douglas Aircraft Co. for U.S. Navy
1970-92	Manufacture/assembly of aircraft components	Douglas Aircraft Co.
1992-Pres.	Storage/distribution of aircraft spares, Storage of production line material and tooling	Douglas Aircraft Co. for McDonnell Douglas (now Boeing)
1996-Pres.	Site investigation, demolition and redevelopment	Boeing Realty Corp. (formerly McDonnell Douglas Realty Co.)

SOURCE: Boeing

1.3 SITE CHARACTERIZATION STUDIES

Since the mid-1980s, the C-6 facility has undergone several site characterization studies. To date, the most thorough investigations of Parcel A have been the Phase I environmental assessment and Phase II soil characterization studies conducted by Kennedy/Jenks Consultants in 1996 and 1997 (K/J 1996a and K/J 1997). These assessments and other important investigations of the entire C-6 site are summarized below. For the site-wide studies, only information pertaining to Parcel A is discussed. For the Parcel A Phase I study, only soils data are discussed.



Initial and Phase I Studies

Woodward-Clyde Consultants conducted the first investigations of the C-6 facility during its underground storage tank (UST) management program (WCC 1987). Elevated levels of organic compounds were reported, indicating the soil had been impacted by leaks from the tanks.

After this initial round of soil sampling, Woodward-Clyde and James M. Montgomery Consulting Engineers conducted expanded investigations of the area (WCC 1990 and JMM 1992). The key results of these studies can be summarized as follows:

- Tank 15T was the suspected source of the contamination.
- Three classes of organic compounds were detected in the soil - aromatics, chlorinated hydrocarbons, and ketones.
- The most prevalent hydrocarbons found were toluene, xylenes, TCA, and TCE.
- No solvents were detected in the surface soil (0 to 10 feet bgs).
- Elevated levels of organic compounds were detected in soil samples extending from 15 feet to groundwater (75 feet bgs).

The next major investigations occurred in preparation for the demolition and redevelopment of the C-6 facility: the Phase I environmental assessments of Parcels A, B, and C conducted by Kennedy/Jenks (K/J 1996a, 1996b, 1996c). These comprehensive assessments present areas within each parcel believed to be of environmental interest, including areas where contamination had already been detected, where chemicals were used or stored, where surface staining was visible, or where sumps, tanks, or clarifiers were located.

Parcel A Phase II Study

After the Phase I environmental assessments, Kennedy/Jenks conducted a Phase II soil characterization of Parcel A (K/J 1997). Under RWQCB supervision, 108 soil borings were installed and 550 soil samples collected and analyzed for volatile organic compounds (VOCs) and total recoverable petroleum hydrocarbon (TRPH). Selected additional analyses, including



Title 22 metals, polychlorinated biphenyls (PCBs), pesticides, and cyanide, were performed on an area-by-area basis. Elevated levels of constituents were found in the following areas:

- Former Building 36, where elevated levels of 1,1-DCA, DCE, cis-1,2-DCE, TCA (at 20 feet bgs) and TCE (at 20 feet bgs) were detected. High concentrations of BTEX were also found at 20 feet bgs with toluene being the most prevalent aromatic hydrocarbon detected. Concentrations were found to be highest and have the widest lateral distribution between 20 to 40 feet bgs.

Lithologic changes in this interval are believed responsible for the lateral distribution. Soil changes from mostly clay to primarily silts and even sand at this interval. The lateral extent of concentrations in excess of 500 ppb is limited to the area along the western side of the Building 36 footprint and north to the southern end of the Building 37 footprint.

- Former Building 66-1 Washdown Area, where TCE, ethylbenzene, xylenes and other VOCs were detected at 1 foot bgs.
- Northeastern Portion of Area 1, where lead was detected in two samples at 1 foot bgs but not at lower depths.
- Southern Portion of Supplemental Area Northeast, where concentrations of petroleum hydrocarbons were detected at 6 feet bgs, decreasing to non-detect below 10 feet bgs. The impacted soils are near a recently discovered pipeline that apparently led from two aboveground storage tanks originally used to store diesel fuel.

Excavations During Demolition

Investigation of Parcel A soils continued during the demolition of buildings and structures in 1997 and 1998 in an effort to identify any areas of soil contamination. Remedial excavation was conducted during demolition in accordance with the Sampling and Analysis Plan for Demolition Activities (IESI 1997a). A grid sampling approach was used to collect soil samples from freshly exposed areas in which building slabs, foundations, or other structures had been removed. A photo-ionization detector (PID) was used to determine concentrations of VOCs. Soils with a PID reading exceeded 5 ppm, or visible staining, or noticeable odors were excavated. Soils containing constituents at levels exceeding self-imposed health-based screening criteria (IESI 1997b) were excavated until sampling results indicated that screening criteria were met or until a depth of 12 feet was reached.



1.4 CURRENT CONDITIONS

McDonnell Douglas (now Boeing) began a phased redevelopment of the 170-acre C-6 property in 1996. Redevelopment of the northernmost portion of the property, Parcel A, began in 1996 and is ongoing. Parcels of the property impacted by each phase of the redevelopment will undergo, as required, environmental investigation, assessment, and excavation prior to construction.

Parcel A demolition is complete. All 9 buildings (725,000 square feet) have been razed, and the parcel has been graded for redevelopment. At the request of DTSC (IESI 1998b), three arsenic-impacted areas (containing eight hits) are being excavated and will be sent off site. It is important to note that this post-demolition risk assessment assumes these hot-spots will be remediated to background concentrations. Integrated and Boeing have agreed to perform confirmation sampling of these areas after remediation and provide the results to RWQCB and DTSC to substantiate the findings of this risk assessment. DTSC has agreed to this approach to allow for conditional approval of the risk assessment while the requested, limited arsenic removal progresses.

Almost 75 percent of the parcel (27.5 acres) has been sold and is awaiting agency approval of soil closure and title transfer. Before title transfer, 2 feet of clean, imported clayey soil will be placed over the 39.5 acres of Parcel A. This material is required to meet the specified grading conditions for the future site owner. However, the maintenance of this material will not be specified in the proposed deed restrictions. Therefore, this risk assessment estimates potential health effects both with and without the fill material.

1.5 SURROUNDING LAND USE

The surrounding area is characterized by a mixture of industrial, commercial, and residential land uses. Two National Priority List (NPL) Superfund sites and one California Superfund site border the C-6 property, while three other known hazardous-waste-impacted sites are within a half mile (see Figure 1-3).

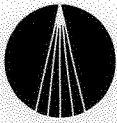


FIGURE 1-3
NEIGHBORING HAZARDOUS-WASTE-IMPACTED SITES

The C-6 property is currently zoned as heavy industrial (M3-1). The area north of the facility is zoned as light industrial (M2-1). The area to the south of the facility is zoned for commercial manufacturing; however, some residential single family homes and apartments are located there (CDM 1991).

Several of the properties adjacent to C-6 have undergone extensive environmental investigation and are known to have contributed to the regional contamination of groundwater in the area. The more environmentally significant properties include the Montrose Chemical, Lockheed Martin International Light Metals (ILM), and Del Amo sites.

Montrose Chemical, adjacent to the south side of the C-6 facility, is an NPL Superfund site. The site was used between 1947 and 1982 for the production of the pesticide DDT. The Montrose facility was dismantled in 1985 (CDM 1991). An environmental cap now covers the entire site. Potential future uses of the property are unknown.



The Lockheed Martin ILM facility, adjacent to the west of C-6, was used between 1946 and 1992 for metals production. The types of wastes produced at the site include waste TCA and petroleum-based solvents, waste oils, and PCBs (K/J 1994). All structures at the facility have been razed, and the top 10 feet of soil have been remediated under DTSC supervision. Redevelopment of the property is underway.

The Del Amo NPL Superfund site is 1500 feet east of C-6, across Normandie Avenue. Between 1942 and 1969 the site was used to manufacture synthetic rubber (K/J 1994d). Aqueous sludges produced during manufacturing operations were disposed on site in three large, shallow evaporation ponds and six sumps. The ponds contained high levels of polynuclear aromatic hydrocarbons (PAHs) and lower levels of VOCs (CDM 1991). The Del Amo site is currently under EPA jurisdiction, and remedial investigations are underway (K/J 1996a, 1996b, 1996c).

1.6 RISK ASSESSMENT METHODOLOGY

As discussed, this post-demolition risk assessment evaluates the potential health impacts to human receptors associated with post-demolition site conditions at Parcel A and the proposed development of the parcel as a commercial/industrial facility. As shown in Figure 1-4, the risk-estimation methodology consists of six distinct steps, some of which may be performed concurrently.

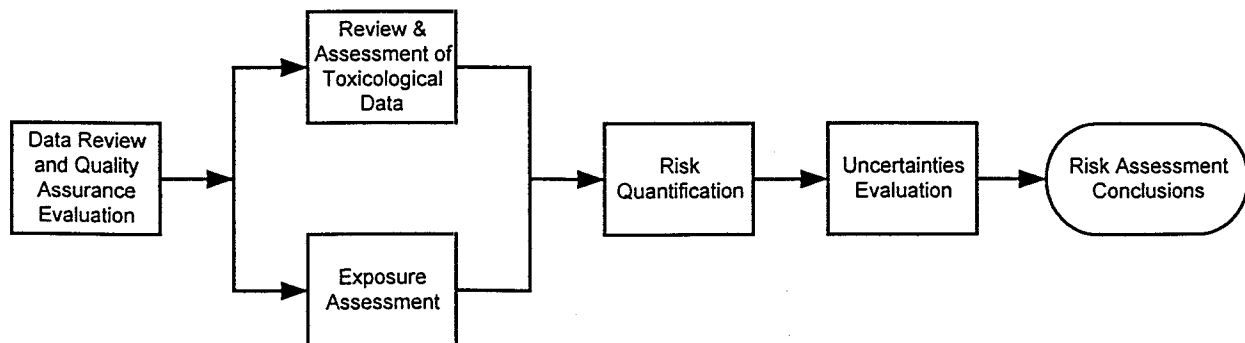


FIGURE 1-4
POST-DEMOLITION RISK ASSESSMENT PROCESS



First, the post-demolition data associated with Parcel A were reviewed and the analytical results compiled. The data were screened according to data usability criteria established for risk assessment. Of the data meeting these quality criteria, constituents of potential concern (COPCs) were selected based on frequency of detection, mobility, and persistence.

Second, those COPCs for which EPA toxicity data exist - as published in the California Cancer Potency Factors Update, Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) - were selected for risk analysis. For COPCs without such toxicity data, health-based evaluations could not be completed.

In Step 3, comprehensive post-demolition exposure scenarios were developed that describe the potential exposures at Parcel A and provide a basis for quantifying those exposures. Each exposure scenario was developed to address the source of residual COPCs, route or mechanism of exposure, and potentially exposed populations (known as "receptors"). When site-specific data for scenario development were unavailable, conservative values found in the literature were used.

In Step 4, the toxicity and exposure assessments were summarized and integrated into quantitative expressions of risk. Specially designed spreadsheets were developed to calculate COPC-specific, multipathway risks for each of the Parcel A receptors.

Usually, the risk values presented in a risk assessment are not fully probabilistic estimates of risk but conditional estimates given a considerable number of assumptions about exposure and toxicity. Thus, it is important to fully specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective. This process is conducted in Step 5.

Step 6 involves the development and presentation of conclusions that can be inferred from the findings of the risk assessment. This step is useful in providing risk managers insight into the interpretation of the risk assessment results.



1.7 GUIDANCE DOCUMENTS

The following major guidance documents and/or information sources were used in the preparation of this risk assessment:

- Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities (Cal/EPA 1992)
- Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual, Part A (EPA 1989a)
- Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual, Part C, Risk Evaluation of Remedial Alternatives (EPA 1991a)
- Guidance for Data Usability in Risk Assessment (EPA 1992c)
- Exposure Factors Handbook (EPA 1990a)
- Dermal Exposure Assessment: Principals and Applications (EPA 1992a)
- California Cancer Potency Factors (Cal/EPA 1996)
- Integrated Risk Information System (IRIS) database (EPA 1997a)
- Health Effects Assessment Summary Tables, Annual FY-1997 (EPA 1997b)
- Superfund Exposure Assessment Manual (EPA 1988c)

1.8 REPORT ORGANIZATION

The COPCs for Parcel A are identified in Section 2. This section discusses data sources used in the post-demolition risk assessment within the context of a hierarchy developed on the basis of the data quality criteria. Section 2 also presents the methodology used to determine the preliminary and final lists of COPCs.



Section 3 summarizes toxicity information (both carcinogenic and noncarcinogenic effects) for each Parcel A COPC. This section also identifies the toxicity criteria used to characterize potential health risks.

The conceptual exposure model is addressed in Section 4. This section characterizes the physical and chemical setting of the C-6 site, with an emphasis on Parcel A COPC sources, land use, current geological and hydrological conditions, and potentially exposed populations. Through the Parcel A conceptual exposure model, possible exposure pathways are identified, and those pathways deemed significant to the identified receptors are selected for quantitative evaluation.

Exposure point concentrations are calculated in Section 5. The statistical evaluation of soils data and air transport analysis is presented.

Potential health risks to the exposed receptors are characterized in Section 6, Risk Characterization. This section presents the risk characterization methodology and health risk estimates for the Parcel A land use and associated exposure scenarios developed in Section 4.

Uncertainties associated with the predicted risk values are discussed in Section 7. The potential magnitude and direction of bias that may be introduced by each uncertainty factor to the predicted risk values are evaluated. The discussion includes identification of uncertainties related to COPC selection, exposure assessment, toxicity determination, and risk characterization.

Section 8 presents a summary of findings and the conclusions/recommendations of this report as to the health protectiveness of the post-demolition Parcel A and its proposed commercial/industrial land use.

The references used in the development of this report are presented in Section 9.

To assist the reader in understanding how the risk values were derived, risk calculation sheets and additional necessary information are presented in appendices.



Computer printouts from the ISCST3 air dispersion model of the COPCs are presented in Appendix A.

Appendix B is a complete set of COPC intake and risk calculation sheets arranged by receptor. Both carcinogenic and noncarcinogenic risk calculations are presented for each receptor via each significant exposure pathway.

Appendix C contains the complete set of data used in the post-demolition risk assessment. Statistical summaries are also provided.

The equations used in the statistical evaluation of the post-demolition data set are presented in Appendix D.

The Peclet calculation used to identify vapor transport mechanisms at the site is presented in Appendix E.